

251118

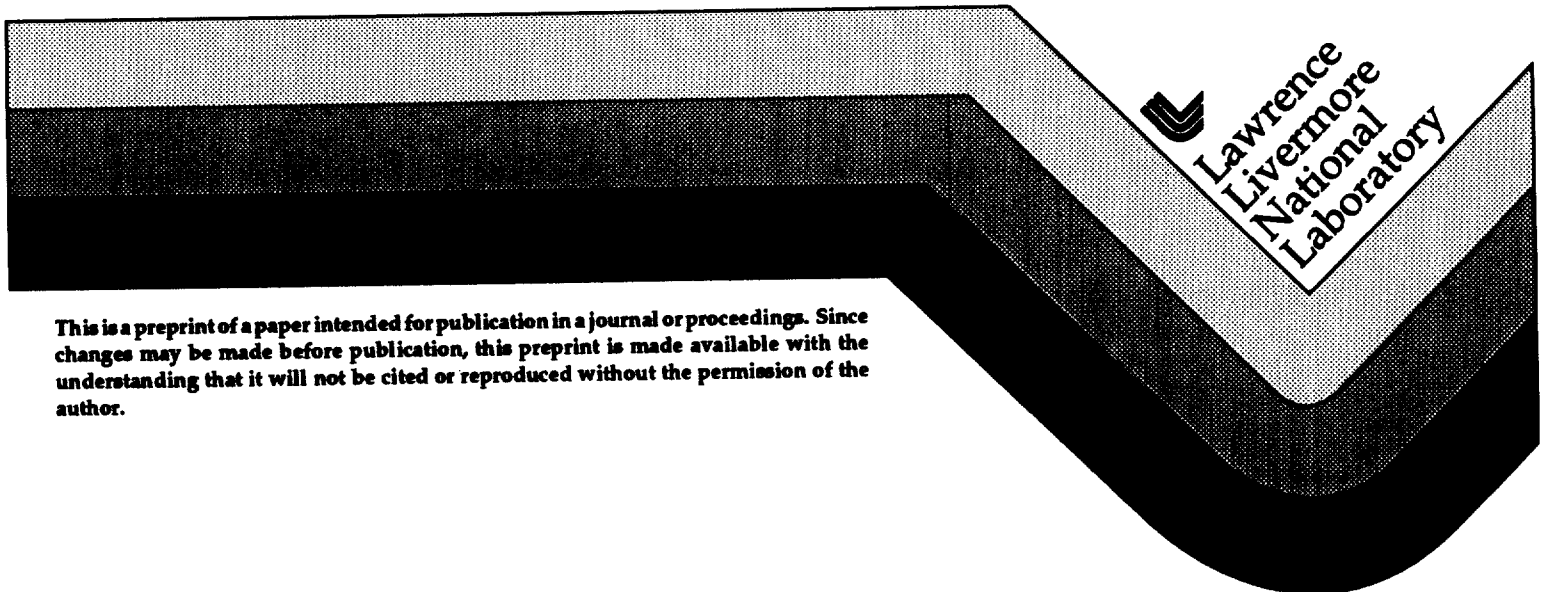
UCRL-JC-124515
PREPRINT

A Tunable, Single Frequency, Fiber Ring at 1053 nm

R. B. Wilcox

**This paper was prepared for submittal to
2nd Annual International Conference on Solid-State
Lasers for Applications to Inertial Confinement Fusion
Paris, France
October 22-25, 1996**

February 21, 1997



This is a preprint of a paper intended for publication in a journal or proceedings. Since changes may be made before publication, this preprint is made available with the understanding that it will not be cited or reproduced without the permission of the author.

DISCLAIMER

This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor the University of California nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or the University of California, and shall not be used for advertising or product endorsement purposes.

A tunable, single frequency, fiber ring at 1053 nm

Russell B. Wilcox
Lawrence Livermore National Laboratory
PO Box 808, Livermore, CA 94550

This laser is a tunable source designed for applications where a shorter pulse will be chopped from a long Q-switched pulse by electrooptic modulators, then amplified in Nd:phosphate glass.

The laser employs ytterbium-doped silica fiber as the gain medium, pumped by a laser diode at 980nm. Gain in Yb:silica is distributed over an 90nm range, making it suitable for operation at many wavelengths (1). Our previous experiments with this medium demonstrated oscillation over a 50nm wide band (2). In addition, pumping at 980nm allows the use of stable pump diodes used in erbium-doped fiber amplifiers (EDFA's). To take advantage of this wideband gain medium, and yet operate on a single cavity mode, we designed the laser of figure 1.

A circulator causes unidirectional operation, and allows use of a fiber grating in reflection. This grating has a 0.2 Angstrom bandwidth, and defines the coarse tuning of the laser. It is piezoelectrically stretch tuned to the desired wavelength band (3). A single mode of the cavity is selected by a piezoelectrically tuned fiber grating Fabry-Perot etalon with 64MHz bandwidth.

The laser is Q-switched by a bulk acousto-optic device at 1kHz repute. The loss is controlled to allow the oscillator to lase close to threshold for 500 μ s before the Q-switch is turned off completely, creating a pulse (see figure 2). This "pre-lasing" stabilizes the single mode, since Q-switch pulse builds up from the pre-lase level (4).

To prevent mode hopping during long term operation, cavity length is feedback controlled. Another piezoelectric device stretches a fiber in the cavity according to an error signal derived from the output optical signal.

Due to the long, high loss cavity, the Q-switched pulse is about 300ns long. The central part of this pulse will be gated by an electrooptic modulator to produce a 30ns square pulse, used for further amplification and modulation.

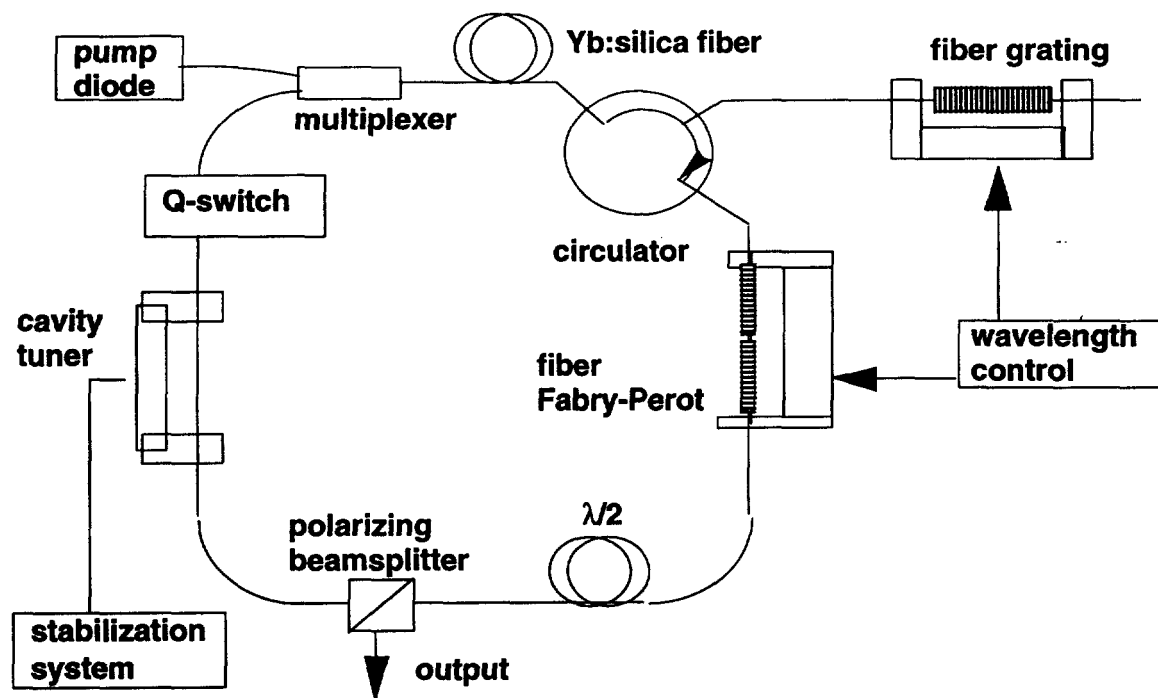


Figure 1. Fiber ring laser optical schematic.

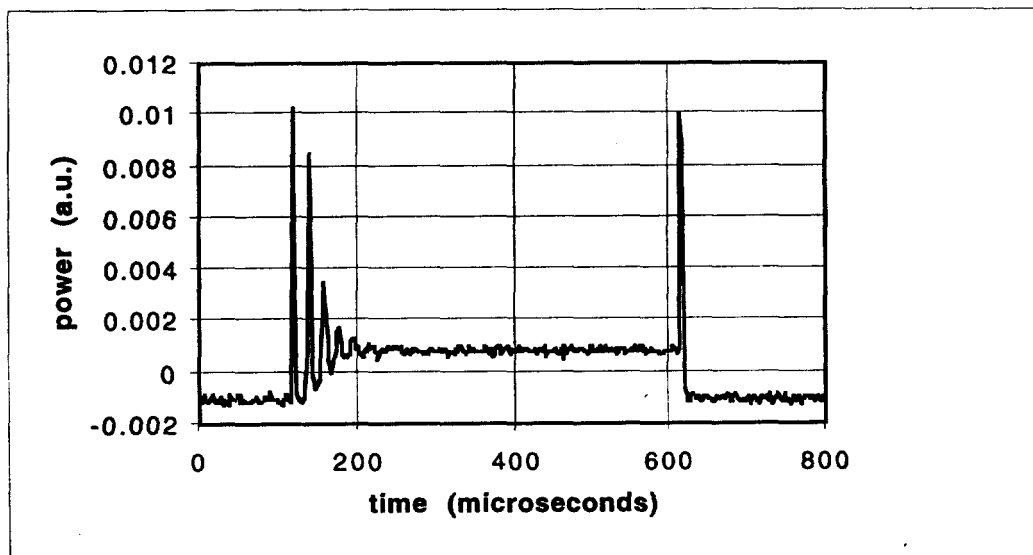


Figure 2. Optical power in laser cavity during stabilization period before Q-switching. Note dampened relaxation oscillations at start.

References

1. H. M. Pask et al, *IEEE J. of Selected Topics in Quant. Electron.* 1, 2, (1995).
2. S. C. Burkhart et al, *SPIE Proc.* 2633, 48, (1995).
3. G. A. Ball and W. W. Morey, *Opt. Lett.* 17, 420 (1992).
4. D. Kuizenga, *IEEE J. Quant. Electron.* QE-17, 1694 (1981).

*Work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract W-7405-ENG-48